SPECIFICATIONS

PERFORMANCE

VERTICAL AMPLIFIER

Sensitivity Range: 10 mV-120V p-p/Cm.

Bandwidth: Constant bandwidth, D.C. or 2 c's (A.C. coupled) to 4 Mc's —3 db approx. from 30 mV to 120 V.
D.C. or 2 c's to 2 Mc's —3 db at 10 mV p-p/cm.

Rise Time: Approx. 0.07 uSec from 30 mV. Less than 2% ringing or overshoot.

Calibration: Stepped attenuator in a 1-3-10 sequence with a 30-1 vernier providing a continuously variable setting and extending the range to 120 V/Cm.
Attenuator accuracy ± 2%.
Vertical amplifier calibration within 10%.

Deflection: Greater than times 2 screen diameter below 1 Mc's, 4 cm. at 5 Mc's.

Impedance: Constant at 1 MΩ and 35 pf approx. at all settings.

Linearity: Better than 3% at 10 cm. deflection at 1 Kc's.

HORIZONTAL AMPLIFIER

Sensitivity: 2 V p-p/Cm. to 10 V p-p/cm. approx. continuously variable.

Bandwidth: D.C. to 400 Kc's - 3 db.
D.C. to 600 Kc's - 6 db.

Impedance: Constant at 1 MΩ and 100 pf approx.

TIME BASE

Range: 1 uSec to 100 mSec/cm switched in a 1-3-10 sequence with a continuous Vernier control between each step, extending the range to slower than 0.5 Sec/Cm.

Modes: Triggered or free running. Free running range 0.2 c's to 100 Kc's.

Deflections: 10 Cms. at times 1 expansion.

Calibration: Within 10% at times 1 expansion.

Expansion: Greater than times 5 (50 cms) up to 10 uSec/Cm.

Linearity: Within 2% at times 1 expansion.

TRIGGER AND SYNCHRONISING

Trigger: Amplitude selection of positive or negative waveforms with automatic sweep triggering at approx. 50 c's to provide a reference base line with no input signal.

± Internal	1 Cm. 5 c's to 1 Mc approx. 4 Cm. 3 c's to 1.5 Mc. minimum	Sine Wave
— External	1 V RMS 10 c's to 1 Mc 10 V RMS 3 c's to 1 Mc.	
± 50 c's		

Synchronising: (Free running Mode):
± Internal 1 Cm. 5 c's to 1 Mc
4 Cm. 3 c's to 3 Mc's.
± 50 c's.
External Sync/Trigger input 1 Meg and 50 pf approx.

GENERAL

C.R.T.: 5-inch diameter, flat-faced type DG13/14, operating at 2.2 KV. Fitted with a detachable calibrated graticule (engraved with 10 x 10 Cm squares) and a light filter. Normally supplied with a green medium persistance phosphor. Long persistance phosphor available to special order, together with suitable filters.

Unblanking: Direct coupled for constant intensity and focus.

'Z' Input: 0.01 uf and 15K 20 V p-p required to blank trace.

Calibration: 50 c's square wave switched to Vertical Amplifier input.
Accuracy ± 2%.

Power Requirements: 220-240 volts, 50-60 cycles, 80 watts.

Dimensions: 11½" high x 8¾" wide x 18" long overall.

Weight: 25 lbs. approx. Shipping weight: 32 lbs. approx.

Finish: The instrument is contained in a rigid, lightweight case with recessed front and rear panels. The case is finished in hard-baked grey brocade with a contrasting light grey front panel. All internal metal components are cadmium-plated and fully passivated. Instrument specification to K114D Environmental and Dept. of Supply Specification CPT/3.

Warranty: The instrument is guaranteed for a period of twelve (12) months against faulty materials and workmanship, with the exception of the electron valves, which are covered by their manufacturer's own warranty.

Price: Model 500B.
Plus Sales Tax if applicable.
Please refer to our Conditions of Sale for further information.

Accessories: (Supplied with Instrument) —
1 Handbook, complete with circuit.
1 9-ft. power cord and 3-pin plug.

Optional Extras:

Screen lead with prods and clips	P31
High impedance probe	P21
Demodulator probe	P11
Viewing Hood	VH/5
Co-ax. to terminal adaptor	CTA

4 mm. plugs.
Co-ax. plugs — UHF.

DISTRIBUTOR:

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CLASSIC WIRELESS
BOB YOUNG
39 SWITCHBACK ROAD
CHURCHILL 3842
5122951

5" PORTABLE OSCILLOSCOPE

MODEL 500B & 500B/D (Differential Input)

1. GENERAL — Model 500B is a rugged portable 5" general purpose oscilloscope for visual observation and measurement of recurrent or intermittent phenoma.

The bandwidth of D.C. to 4 Mc's at a sensitivity of 30V p-p/cm. and 2 Mc's at 10mV p-p/cm ., enables the instrument to be used for measurement of audio, sub and ultra sonic frequencies, pulse and square waveforms and with R.F. oscillators or transmitters at frequencies up to 10 Mc's. The instrument is ideally suited for use with television and radar equipment. It's high frequency performance with fast rise time, together with a stable triggered sweep generator enables fast pulses to be clearly displayed.

Calibration of both voltages and time are maintained within ± 5% and maintain this accuracy over widely varying supply voltages.

The incorporation of direct reading controls for both time and amplitude make the instrument very easy to use. Immediate changeover from a repetitive to a triggered mode for the time base by means of a front panel stability control together with the facility to select positive or negative waveforms for sweep triggering, allows the operator to select the desired operating characteristic for the particular measurement in hand. For balanced measurements a differential input version is available under the code 500B/D.

A folding tilting bail is fitted to elevate the front of the oscilloscope for convenient viewing and a green filter increases the contrast of the trace making for easy viewing under normal daylight conditions.

2. C.R.T. — 5" diameter type DG/13/14 operating at approx. 2200V. Normally supplied with green medium persistance phosphor, but long persistance available to special order, fitted with centim eter calibrated graticule and green light filter.

3. PERFORMANCE

VERTICAL AMPLIFIER

Sensitivity — Range 10mV - 100V p-p/cm.

Bandwidth — 10mV p-p/cm D.C. or 2 c's to 2 Mc's -3db approx.
30mV to 100V D.C. or 2 c's to 4 Mc's -3db.

Rise Time — 0.07 uSec.
(Measurements taken with Vernier Gain fully clockwise).
Bandwidth measurements made against a reference level of 4 cms. deflection at 1 Kc's.

Vertical deflection - greater than 10 cms. up to 1 Mc's.
Greater than 5 cms at 5 Mc's.

Shift control permits a minimum of ± 6 cm. of movement of trace.
Input impedance Single ended constant at 1 MΩ and 50 pf approx.
Differential 2 MΩ and 25 pf. approx.
Attenuator accuracy better than ± 2%
Sensitivity switched in 1-3-10 steps from 10mV p-p/cm. to 30V p-p/cm. with a 3-1 vernier providing continuously variable setting and extending range to over 100V p-p/cm.

HORIZONTAL AMPLIFIER

500mV p-p/cm to 10V p-p/cm.
Bandwidth D.C. to 200 Kc's -3db approx.
Input impedance constant 1 MΩ and 100 pf. approximately.

SWEEP GENERATOR (TIME BASE)

Free running (repetitive) or triggered 1 uSec/cm to 100mSec/cm. calibrated in 1-3-10 steps with continuous vernier control from 1 uSec/cm to 500 mSec/cm.
(1 cycle/5 sec. to 100 Kc's approx).
Sweep expansion continuously variable to 50 cms minimum up to 10 uSec/cm.
Sweep Sawtooth waveform of 30V p-p available at front panel at approx. 1000Ω impedance.
Calibration of sweep speeds within 5%.
Linearity better than 2% at 10 cms. deflection.

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SYNCHRONISING

	Internal	Positive or Negative.
	1 cm. deflection	5 c's - 1 Mc's.
	4 cm. deflection	2 c's - 2 Mc's.
Trigger	1 cm. deflection	5 c's - 1 Mc's.
	4 cm. deflection	2 c's - 1 Mc's (Square wave down to zero frequency)

Sync. input 1 MΩ and 30 pf. approx. constant.

Z - BEAM MODULATION

A negative going waveform of 20V p-p will blank out trace at normal brilliance. Input 0.01 uF and 15 K ohms.

POWER REQUIREMENTS

220 - 240V. 50 - 60 c's approx. 80 watts.

4. FUNCTION OF CONTROLS

The controls on the front panel are largely self-explanatory and are grouped together in their functions for ease of operating. A full description of their various functions is listed below :-

A.C. ON - OFF — Applies power to the instrument.

INDICATOR — Neon lamp indicates power is on .

FOCUS - ASTIGMATISM

Dual concentric control. The Red knob controls the focusing voltage of the C.R.T. whilst the Black knob sets the potential of the final anode on the C.R.T. to obtain the best focus both in the vertical and horizontal planes. The controls should be operated in conjunction with each other to obtain an optimum focus.

STABILITY - HORIZONTAL GAIN

Dual concentric control. The Red knob has a number of functions. Fully anti-clockwise with the white line pointing to the EXT. INPUT, the sweep generator is made inoperative and an external signal may be fed in-to the HORIZONTAL INPUT socket (to the right of the knob) to form the horizontal trace. Rotation of the red knob in a clockwise direction will bring the sweep generator into a triggered conditions, whilst rotation around to the fully clockwise position marked F.R. will cause the generator to free run.

SHIFT CONTROLS

The two shift controls are located in the centre of the instrument and their direction of operation is indicated by the arrows alongside.

VERNIER

Allows any frequency between the steps on the Sweep Generator range to be selected. Vernier must be fully clockwise to obtain the calibrated figures shown on the range switch.

TIME BASE RANGE

Selects 11 pre-set time base speeds calibrated in mSec. or uSecs/cm. To obtain these speeds the HORZ. GAIN Control must be fully anti-clockwise (10 cm. trace) and the VERNIER must be clockwise. With the HORZ. GAIN rotated fully clockwise and the trace expanded to over 50 cms. and the time base speeds are increased correspondingly.

TRIGGER SELECTOR

Selects the sync. or trigger signal to lock the time base to the displayed waveforms.

TRIGGER SELECTOR

Vernier control selects the level of a waveform required to lock to trace or in the 'AUTO' position, provides a continuous base line with no display and automatically triggers immediately a signal is applied to the vertical amplifier or EXT. trigger input.

VERTICAL AMPLIFIER ATTENUATOR

Switches in various calibrated attenuator networks to allow the vertical display to be conveniently displayed on the CRT face. In conjunction with its associated -

VERNIER control permits any waveform from less than 10mV p-p to 1000V p-p to be displayed and measured.

D.C - A.C. switch places a capacitor in series with the input lead to remove the D.C. component of the input signal before amplifying.

5. PRESET CONTROLS

BALANCE Control under the C.R.T face is adjusted so that the trace with no signal applied to the vertical input terminal does not move up or down when the Vernier control is turned - See maintenance section.

VERTICAL CENTERING (L.H. side of cabinet)

Adjusts the balance of the input stage so that the shift control operates in the middle of its range.

CALIBRATE Adjust to obtain a 4 cm. deflection of calibration waveform when attenuator switch is turned to CAL. position.

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PANEL TERMINALS & SOCKETS

R.H. SIDE T.B. When the sweep generator is operating normally, either free running or triggered, a 30V p-p negative going sawtooth waveform is available at this Socket superimposed on approx. +60V D.C.

HORIZONTAL INPUT

Input socket for horizontal displays when internal time base is not required.

BOTTOM L.H. SIDE OF PANEL

VERTICAL INPUT & EARTH Input socket for vertical input signal 500B Model.

POS. OR NEG. INPUT SOCKETS Differential input Model 500B/D.

BOTTOM R.H. SIDE OF PANEL

EXT. Input socket for external sync. or trigger when selector switch is in EXT position.

REAR OF INSTRUMENT

Z Input socket for beam brightness modulation negative signal will brighten trace.

MAINS TAPPING PLATE Permits selection of operating voltage to suit local A.C. mains supply.

OPERATION OF OSCILLOSCOPE MODEL 500B & 500B/D

Unless you are familiar with the triggered time base incorporated, it is advised that the following proceedure be followed to become familiar with the instrument.

Set the front panel controls as follows -

FOCUS/ASTIG.	Mid position.
STABILITY	Clockwise.
HORZ. GAIN	Anti-clockwise.
HORZ. SHIFT	Mid position.
VERT. SHIFT	Mid position.
TIME BASE VERNIER	Clockwise (CAL).
TIME BASE SWITCH	3 mSec.
TRIGGER SELECTOR	A.C. +.
TRIGGER LEVEL	AUTO
ATTENUATOR VERNIER	Clockwise (CAL)
ATTENUATOR SWITCH	CAL.

Switch on and allow a minute for the instrument to warm up. Advance intensity control until a display is seen. Centre with shift controls.

Now turn STABILITY control anti-clockwise until trace disappears, then rotate clockwise again until display reappears in a stable locked condition. The STABILITY control will not need further adjustment and is in its correct operating position. Adjust the ASTIG. & FOCUS to obtain a sharp display.

Now turn the TRIGGER LEVEL control from the AUTO position. The trace will disappear and then when rotated slowly it will re-appear and it will be observed that the start of the trace moves slowly up and down the calibration waveform as the control is rotated. This is the LEVEL selection facility.

With the TRIGGER SWITCH set to -A.C it will be noticed that triggering now occurs on the falling slope of the waveform.

The A.C or - positions will be the positions normally used in conjunction with the 'AUTO' position of the LEVEL control for most applications. However, if a low frequency below approx. 500 c's with noise or high frequencies superimposed is displayed, greater stability of trigger may be obtained in the L.F. + or - positions. Similarly, when high frequencies are displayed with superimposed low frequencies such as T.V. line frequency signal, the H.F. + - positions may provide better stability of display.

CIRCUIT DESCRIPTION MODEL 500B

Vertical Amplifier Input signals applied to the VERTICAL INPUT terminal are fed to Sw1 the A.C - D.C switch which leaves C1 in series with the input in the A.C position or shorts it out in D.C. A connection is then made to the input attenuator switch Sw2a & c. Sections Swa & b are arranged with increasing compensated attenuator steps between the two sections in a 1-3-10 ratio.

Input signal from the attenuator is applied to V2a valve.

MODEL 500B/D DIFFERENTIAL INPUT

Signals applied to either input terminal are coupled to Sw1a or b, A.C-D.C input selector which leaves C6 & C1 in series with the input in the A.C position or shorts them out in the D.C position. Each signal is then coupled to the attenuator switch Sw2a-e. Both sections attenuate the signal in a 1-3-10 ratio before it is coupled to V2a & V3a input valves.

V2a & V3a pentodes are arranged as a balanced differential amplifier. To produce an approx. balanced voltage across the two anodes with an input applied only to one grid, the two cathode loads are coupled together via potentiometer RV4. RV4 covers a 3.5-1 range without greatly affecting the amplifier response by varying the degeneration in the cathode loads. RV6 is the front panel preset BALANCE control which is set so that the current flowing through R27 & 28 produces an identical voltage at V2a & 3a cathodes, so eliminating movement of the trace when the VERNIER control RV4 is operated. The CENTERING control RV2 balances the anode loads to centre the shift control movement. Compensation for high frequency performance is made by the shunt peaking inductors L1 & 2.

The VERTICAL SHIFT control RV3 is a potentiometer placed between the V2a &3a anodes. Movement of the sliding arm decreases or increases current through the anode loads and therefore, varies the voltage at the two anodes in a symetrical manner - one increasing when the other decreases. This system maintains the necessary balance in the input stage to eliminate trace fluctuations due to variations in supply voltages.

Signals from V2a & 3a are directly coupled into V2b & 3b cathode followers which drive V4 & 5 pentode output amplifiers. The circuit is arranged as a balanced amplifier with matched anode and cathode loads.

Frequency compensation is made by inductors L3 & 4 in the anode circuits and by C22 & 23 across the degenerative cathode resistor R26.

The CRT deflection plates are driven by V6a & b cathode followers to isolate the load and deflection plate capacitance from the output amplifiers.

The series current flowing through the cathode followers V6a & b is filtered by C25 and in conjunction with the output of the regulated supply provided by V10b is then used to supply the input stage anode current and the time base. This arrangement, apart from economy in current provides a very low ripple content supply, and also eliminates fluctuation that occurs in mains supplies, ensuring a very stable presentation of displays on the C.R.T.

TIME BASE

The basic time base employed in this oscilloscope is a Miller integrator saw-tooth generator driven by a bi-stable switch.

V7b is the sawtooth generator, S3a-c time base switch selects the various combinations of C & R necessary to produce each calibrated sweep range. The VERNIER control RV11 varies the applied H.T. to the discharge resistors and changes the sweep rate selected over a 5 to 1 range. V7a is the charging valve. V8a & b the switching valves and D1 the trigger injection diode.

The free running operation is as follows -

With the sweep switched to the slowest speed, C32 & R54 between V7b anode & grid are the discharge circuit. RV12a STABILITY control is set to its maximum resistance value which biases V8a grid into conduction.

With V7b conducting and its anode voltage falling (the stage has zero cathode voltage and its grid is returned to a positive potential), the anode voltage will be fed back to its own grid via C32. However, the grid is endeavouring to rise to the potential present on RV11 VERNIER control to which R54 is connected. This feedback being in opposition to the normal grid voltage rise slows the rate of rise of the grid and linearises the fall at the anode to produce a saw-tooth waveform with a linearity of better than 0.1%.

During the course of this fall, V8a has been conducting heavily and its anode has bottomed at a potential determined by the screen voltage - both grids being at zero bias. As V8a anode is directly coupled to V7a grid, V7a cathode will be positive with respect to its grid and therefore not conducting. V7b anode continues its linear fall until the cathode of V7a reaches its own grid potential so causing it to conduct. This conduction results in a voltage drop across its anode load R56 which is immediately communicated to V8a via C33. A negative fall on 93 of V8a reduces its conduction and its anode voltage rises. As this point is connected to the grid of V7a it also rises, making V7a conduct more heavily, thus its anode potential falls further and a rapid switching action takes place between the two valves until V8a is cut off and C32 is rapidly charged to +150. During this flyback period when the grid of V7b is drawing grid current due to the positive charge being applied to C32, V8b whose grid is directly coupled to V8a anode, conducts heavily as V8a anode has also risen to plus 150V. This conduction results in a fall at V8b anode which assists in switching V8a off via the directly coupled network R68 & C39 & R64. This waveform is also coupled to the C.R.T. grid through a C & R network to blank out the beam on the return trace.

When C32 is fully charged, V7a conduction drops as the voltage across the valve falls and the anode voltage rises. This positive rise is communicated via C33 to V8a which will start to conduct, its anode falls, and drives the charging valve V7a grid negative, and thus the switching between the two valves reverts them back to their original condition, with V8a conducting V7a cut off and V7b starting to discharge C32 whose grid at the commencement of the run down is at zero potential.

However, the initial fall of the anode also appears at the grid via C32 and drives the valve almost to cut off immediately arresting the sharp fall at the anode after approximately 2 volts when the feed back action takes over, the grid now rising slowly positive and the anode falling linearly to produce the next sawtooth time base waveform.

To operate the circuit under TRIGGERED conditions the STABILITY control is adjusted so that V8a is just held at cut off, the quiescent condition then is that, V8a anode is at +150V, V8b at approx. 70V (the C.R.T. is blanked out). V7a is conducting to maintain a charge on the selected timing capacitor and V7b is also conducting waiting to start the run down. If a negative going signal is now fed through D1 to the anode of V8a it will drive V7a grid negative completely cutting it off. Its anode rises and a sharp positive pulse is fed to V8a grid 3. Additionally, C38 & R67 conducts the negative trigger pulse to V8b grid, cutting it off and causing its anode to rise. This rise is then fed to V8a grid 1 via R68 and C39 to make V8a conduct heavily, and as a result the C.R.T. grid is driven positive by the rise of voltage at V8b anode and V7a is cut off by the fall at V8a anode so V7b is able to start its linear run down to produce the sweep waveform. 500 &B/ 365

At the end of the run down V7a again conducts, the fall across its anode load is fed to V8a grid 3, biasing the stage off, which in turn switches V8b on and the circuit reverts to its original condition with V7a charging the timing capacitor, V8b holding V8a just cut off and the C.R.T. blanked out.

SYNC. AND TRIGGER CIRCUIT

Switch Sw6 selects 9 forms of triggering waveform to provide great flexibility of triggering. Internal signals from V6a & b cathode followers are coupled to Sw6 in the A.C. + or - positions. In the H.F. + or - settings the signal is differentiated by C45 or 6 & R82 and integrated in the L.F. + or - position by C43 R80 or 81, 50 c's sync. signals are taken from the 6.3V A.C. supply whilst external signals are capacitively coupled through Sw6 directly to V9b grid from the front panel EXT socket.

The output of Sw6 is capacitively coupled to the grid of V9b which, with V9a forms a Schmitt Trigger circuit producing sharp rectangular waveforms from any input waveform. The grid of V9b is built out from a potential divider placed across the +150V line. Variation of the setting of this divider (Vernier amplitude selector control) controls the firing point of V9 trigger valve and enables selection of the operating point to be made over a ± 4 cm. portion of the C.R.T display. When the control is rotated fully anticlockwise Sw5 is opened leaving V9 capacitively coupled only to the input signal (and the two grids directly coupled via R73). It will oscillate approximately at 50 c's until a signal is fed into it and thereby produce a time base sweep to indicate a ready condition of the circuit.

Trigger pulses are developed across V9a anode and then differentiated before feeding to D1 injection diode, D2 diode removes the positive portion of the differentiated waveform.

Synchronising signals for use under free running conditions are injected simultaneously with the trigger pulses by returning the anode resistor of V8a switching valve to a tap on V9b anode load. At this point a square wave is developed by incoming signals and will therefore affect the bottoming voltages of V8a anode by varying the anode potential. In use, any waveform in the last quarter of a cm. of the sweep length will synchronise the trace.

HORIZONTAL AMPLIFIER

Consists of V10a & V12a pentode balanced amplifier with a preset RV15 and variable gain control (HORIZONTAL GAIN) RV12b between the cathodes. The time base signal is directly coupled to V10a grid via a compensated divider R78/C47 and R86. The horizontal shift voltage obtained from RV14 is fed to the grid of V10a via the grid resistor R86. External signals to the X input socket are directly coupled to V12a grid via RV17 & 16 with C48 providing high frequency bypass. As in the case of the vertical amplifier the horizontal deflection amplifier is directly coupled to the C.R.T. horizontal deflection plates.

POWER SUPPLIES

The main H.T. supply is obtained from V11 rectifier and filtered by C24b & c and resistor R100. A second stage of filtering by R35 C24a is used before supplying the output amplifier valves V4 & 5.

The -140V supply is obtained by ½ wave rectifying a 200V winding, followed by a C.R. filter C52 & 3 and R101.

The +150V line is mainly supplied by the current through V6a & b cathode followers whose cathode loads are returned to the +150V line. To stabilise this rail V10b series pass valve controlled by V12b supplies the additional current necessary and stabilises the line against load on input voltage changes. B4 neon supplied by the -140V line provides the reference for the regulated supply the Horz. shift and the Stability control voltage.

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The C.R.T. negative supply is obtained by half wave rectifying the whole of the 325-0-325 volt transformer secondary and then rectifying the superimposed 325V waveform to produce -1300 volts after filtering by C59 & 60 and R106.

Post deflector voltage of +1200V is developed by voltage doubling the 325V transformer winding by D3 & 4 and adding it to the +350V rail.

C.R.T.

The -1300V supply for the C.R.T. is taken through two separate dividers. One is formed by R103, RV7b FOCUS control, R104, RV8 INTENSITY control and RV9 intensity preset. The second divider supplies the C.R.T. grid via R99, 100 and 110 bypassed for high frequency signals by C50 and diode D8. The top end of this divider is coupled to the anode of V8b where the blanking pulse is developed as previously described, and through C50 to the anode of V7a where the very sharp cut off appears.

MAINTENANCE & ADJUSTMENTS

A number of preset controls are contained in this instrument and may require periodical adjustments to maintain the instrument in full calibration.

Before removing cover, disconnect instrument from the mains supply. Remove the two screws holding the handle and carefully lift off. The base may be removed by unscrewing the rubber feet.

To assist in fault finding, all pertinent voltages are shown on the circuit drawings as measured with a 20,000Ω per volt or valve voltmeter, the oscilloscope being supplied by the correct A.C. mains voltage according to the rear tapping panel. Voltages measured with meters down to 5000Ω/volt will not affect the valves in most cases by more than 10% other than on the EHT supply and associated circuitry.

PRE-SET ADJUSTMENTS

RV1 CALIBRATE VOLTAGE SETTING Calibrate the oscilloscope with an accurately known voltage, then switch attenuator to CAL. position and adjust RV1 to produce a 4 cm. high waveform.

RV2 CENTERING A side panel control which is adjusted to balance the movement of the shift control to obtain 5 cm. of shift either side of centre.

RV5 CALIBRATE switch attenuator to CAL. position and adjust RV5 side panel control to produce a 4 cm. display level adjusted to the flat top and bottom of the waveform.

RV6 BALANCE Set attenuator to 100mV position with vernier fully clockwise, centre trace with vertical shift control, rotate VERNIER anticlockwise, and recentre trace with BALANCE control. No movement of trace in a vertical direction should now occur when VERNIER control is rotated. If necessary repeat procedure until correct result is obtained.

RV9 INTENSITY PRE-SET Turn front panel INTENSITY control fully anticlockwise - i.e minimum brightness. Adjust RV9 so that trace just disappears when sweep is operating normally, e.g with calibrate waveform displayed. Full intensity range will now be obtained for INTENSITY control.

RV10 X1 EXPANSION Set up trace with a waveform displayed and locked in the triggered condition, e.g the calibration waveform. Adjust RV10 to produce a trace just over 10 cms. long.

RV15 TIME BASE Rotate sweep speed switch to 10mSec/cm and sweep VERNIER to fully clockwise position. Switch attenuator to CAL., adjust RV15 to obtain one waveform every 2 cm.

RV19 +150V Preset. Adjust to obtain +150V.

When replacing valves, the following controls will possibly need re-setting as previously described:

V2	RV2, 5 & 6.
V3	RV2, 5 & 6.
V4	RV5
V5	RV5
V6	No change
V7	No change
V8	RV10 & 15
V9	No change
V10	RV10 & 15
V11	No change
V12	RV10, 15 & 19.

NOTE: When replacing V2 & 3 it may be necessary to select valves that show reasonable balance in the instrument, to allow the shift control to have approximately equal movement each way, as this valve is identical to those used in the time base they can be interchanged to produce a balanced pair if necessary.

ALTERNATIVE VALVE TYPES THAT MAY BE EMPLOYED IN MODEL 500B

V2	6BL8, ECF80, E80CF.
V3	6BL8, ECF80, E80CF.
V4	6EJ7, EF184, (6BX6, 6BW7, EF80 will work with reduced gain and bandwidth)
V5	As for V4
V6	6AJ8, ECH81.
V7	As for V2.
V8	6AJ8, ECH81.
V9	As for V2.
V10	As for V2
V11	6V4, EZ80, or 81.
V12	As for V2.

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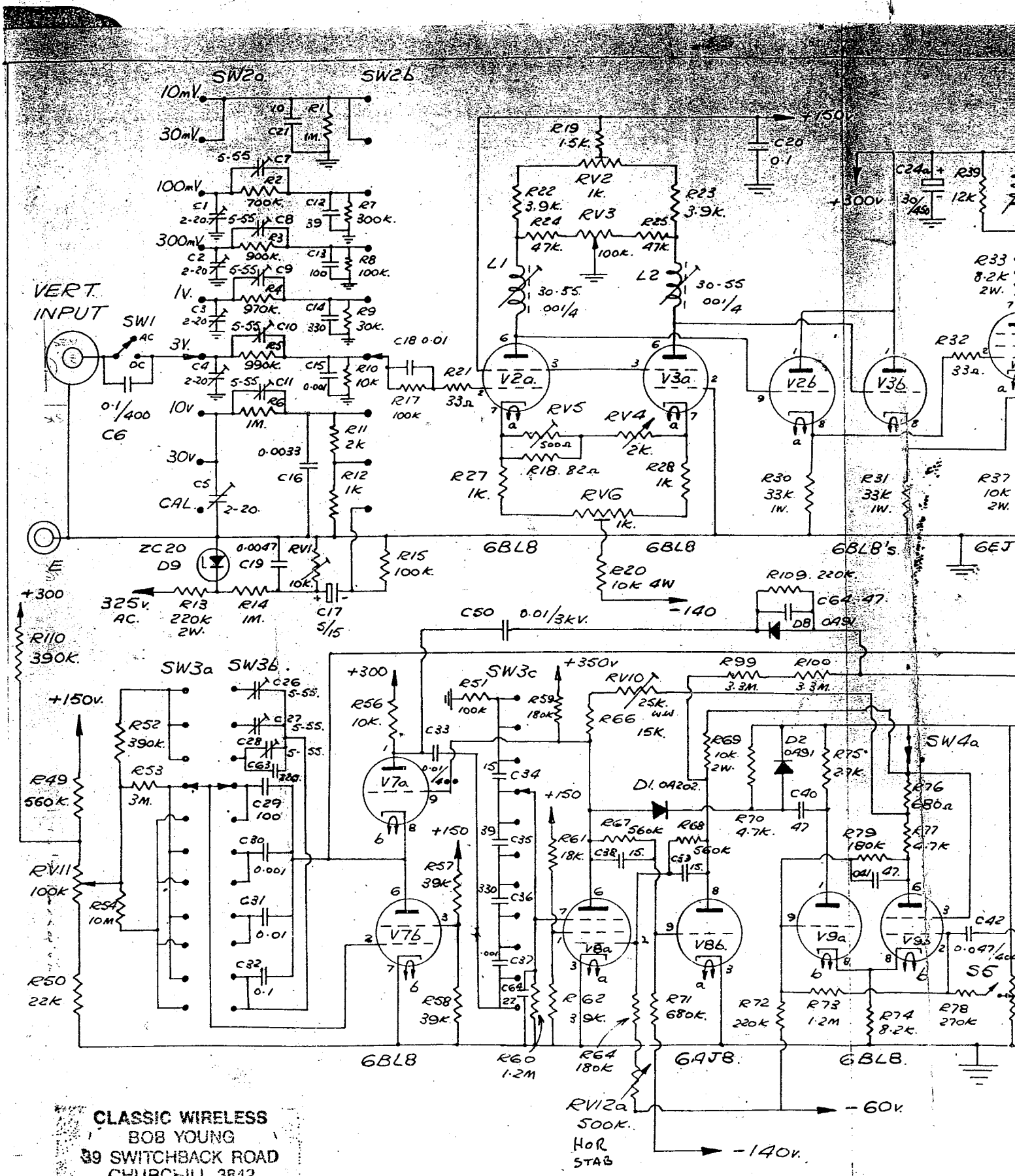
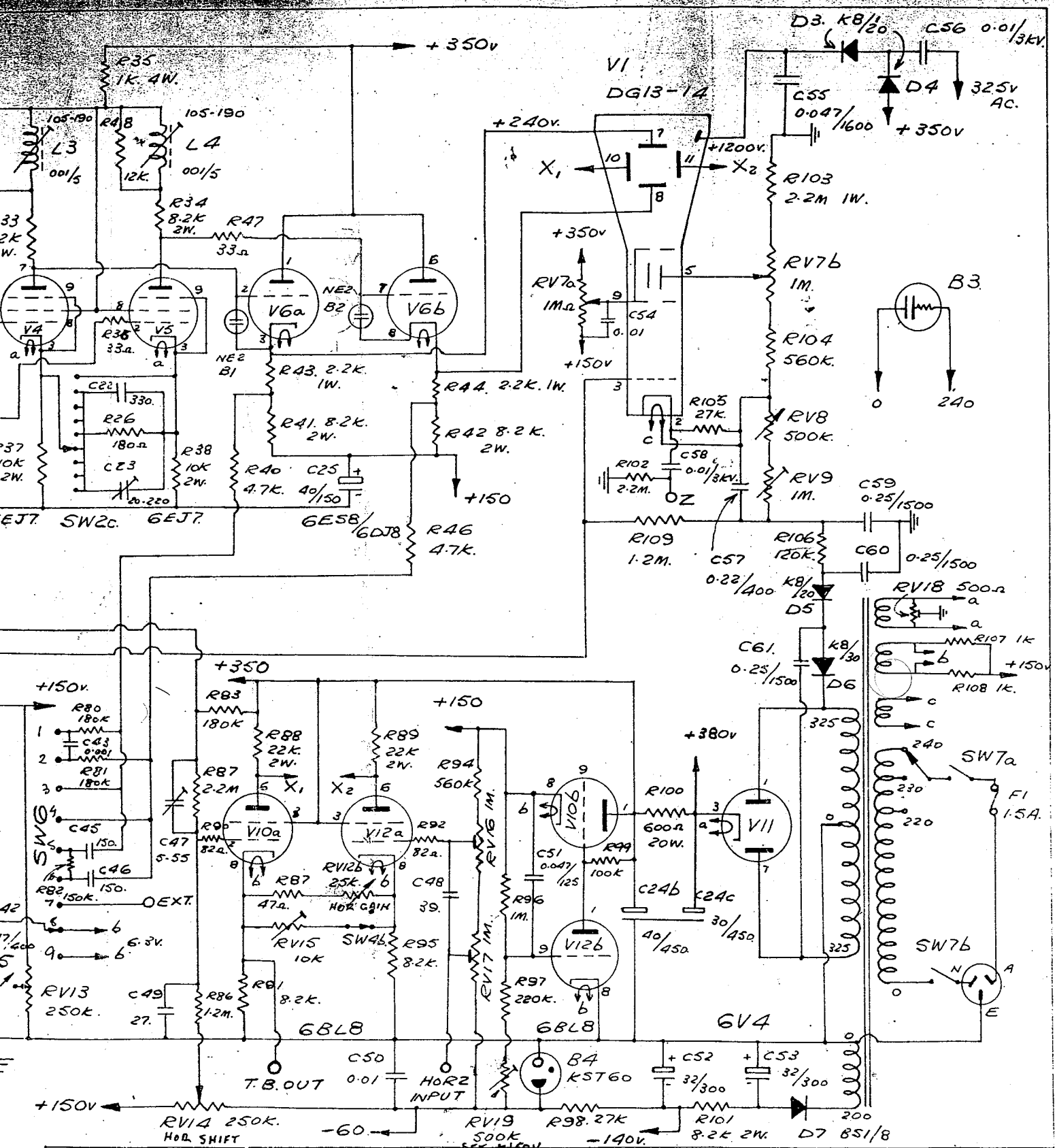
GENERAL NOTES

Every effort is made to keep the circuit diagram up to date, but the right is reserved to adjust values or amend the circuit without notice.

ACCESSORIES (Optional Extras)

1.	Viewing Hood	VH5
2.	High Impedance Probe (10MΩ & 12 pf)	P21/UHF
3.	Demodulator probe 100 Kc's to 100Mc's	P10/UHF
4.	Co-ax (UHF) to terminal adaptor.	
5.	4mm. plugs.	
6.	Screened test leads with crocodile clips and prods.	





ISSUE	500B	B.W.D. ELECTRONICS. P/L. MELB. AUST.	DRG. N°
2 / 4/64	JB. 4/64 TRACED D.H.C.	MODEL 500B 5" OSCILLOSCOPE.	318B.